Day 14	A Level Maths: S Tier 10-a-day
1 A particle of weight W N is on a rough plane inclined at α to the horizontal, where $\sin\alpha = \frac{3}{5}$. A force P N acts up a line of greatest slope; the particle stays at rest for $43.2 \leq P \leq 100.8$. Find (a) W, (b) the coefficient of friction, (c) the acceleration when P = 201.6. Take g = 9.8 m s^{-2}.	
2 A sector of a circle has radius r cm and angle θ radians, where $\theta < 2\pi$. Its perimeter is 34 cm and its area is 66 cm^2. Find the two possible pairs of values of r and θ.	
3 Prove that $(n + 6)^3 - n^3 - 216$ is a multiple of 18 for every integer n.	
4 Solve $e^x + 8e^{-x} = 6$, giving your answers exactly in terms of natural logarithms.	
5 (a) Expand $(25 - x)^{-\frac{1}{2}}$ up to and including the term in x^2. (b) Use x = 0.04 to estimate $\frac{1}{\sqrt{24.96}}$ to 5 decimal places.	

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6 A faulty component is present in 0.5% of a population. A test is positive for 98% of those with it and for 5% of those without it. Find P(positive) and P(has it | positive).	
7 A(−3, −10) and B(3, 8). The point C lies on the x-axis and CA = CB. Find the coordinates of C and the area of triangle ABC.	
8 Use a suitable trigonometric identity to find the exact value of $\int_0^{\pi/4} \sin 5x \cos x \, dx$	
9 A car of mass 1500 kg, with engine power 51.75 kW, climbs a straight road with $\sin \alpha = \frac{1}{10}$ against a constant resistance of 600 N. Find (a) the greatest steady speed up the hill, (b) the acceleration at $\frac{25}{3}$ m s^{-1}. Take g = 9.8 m s^{-2}.	
10 X takes values 2, 3, 4, 5 with P(X = x) = k(x + 1). X_1 and X_2 are independent copies of X. (a) Find k. (b) Find P(X_1 + X_2 = 7). (c) Find P(X_1 = X_2) and E(X_1 + X_2).	